Isco 4200 Series Flow Meters

ACCURATE FLOW MEASUREMENT THAT'S VERSATILE AND EASY TO USE

ISCO®

4200 Series Open Channel Flow Meters

When you need a monitoring system that's accurate, versatile and easy to use, turn to the latest generation of open channel flow meters from Isco. Our 4200 Series is backed by 20 years of experience in flow measurement. You can depend on Isco technology to meet your needs in an increasingly complex monitoring environment.

Maximum Accuracy

Nothing else matters if your flow meter can't measure flow accurately. But inaccuracies result when a single measurement technology is used in a variety of applications. The 4200 Series offers you a choice of four measurement technologies, so you can select the flow meter best suited for your site conditions. Choose from:

- 4210 Ultrasonic
- 4220 Submerged Probe
- 4230 Bubbler
- 4250 Area Velocity

Maximum Versatility

Today, you need a monitoring system with the versatility to perform in a variety of situations. For example, you may be required to collect flow-proportioned samples. Or you may be required to monitor parameters such as pH, dissolved oxygen, conductivity, or temperature. In storm water monitoring, you need to measure rainfall. You may need to be notified when an alarm condition occurs. And in many applications you need to control a process, such as chlorination and pH neutralization.

Versatile Isco Flow Meters satisfy all of your needs! Convenient options customize the 4200 Series for your specific portable and fixed-site applications including:

- Pretreatment Compliance
- Storm Water Runoff Monitoring
- Permit Enforcement
- Sewer Flow Monitoring
- Combined Sewer Overflow Studies
- Wastewater Treatment Plant Operations
- Inflow And Infiltration Studies
- River And Stream Gauging

User-friendly Programming and Data Collection

Fast and Easy Programming

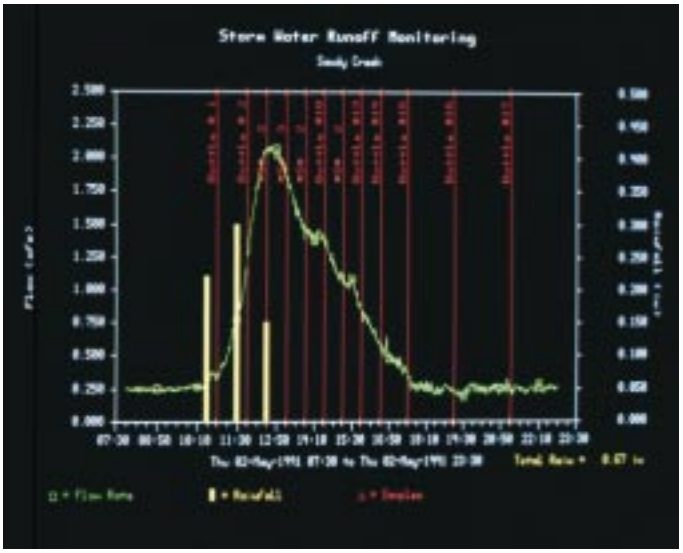
The 4200s are so easy to program, you'll rarely need the instruction manual! Just use the tactile keypad to respond to simple questions on the two-line, 80-character LCD. For added convenience, the LCD is backlit, so it's easy to read even in the darkest manholes.

The 4200 Series contains built-in flow conversions for most applications, or you can enter data points or an equation for special situations. When programming is complete, the 4200 Series displays data in selectable units of measure.

Exclusive Built-in Printer

Isco 4200 Series Flow Meters give you a choice of technologies for collecting data. A built-in dot matrix printer gives you an accurate, on-site printout of monitoring data. The printer plots up to three lines of data, plus rainfall and samples. Simple, easy-to-read summary reports are printed on command or at selected time intervals. You can also print the flow meter program on command.

The exclusive built-in printer provides easy-to-read charts and summary reports.



Flowlink Software produces a variety of informative graphs and reports from stored data.

Powerful Data Storage

The 4200 Series also features internal memory to store over 2 months of flow, rainfall, parameter and sample data at 15 minute intervals. You can retrieve stored data on-site with a laptop PC or an Isco 581 Rapid Transfer Device, or remotely via telephone or short haul modem. Isco Flowlink® Software uses stored data to generate informative graphs and reports.

Convenient Alarm Messages

In addition to transferring stored data over telephone lines, our new telephone modems have voice messaging capabilities. Now your flow meter will notify you when programmed alarm conditions have occurred. This eliminates the need for a separate dialer.

Up to three lines of data are accurately plotted at one of four chart speeds.

Rainfall data from a rain gauge is recorded as a bar graph.

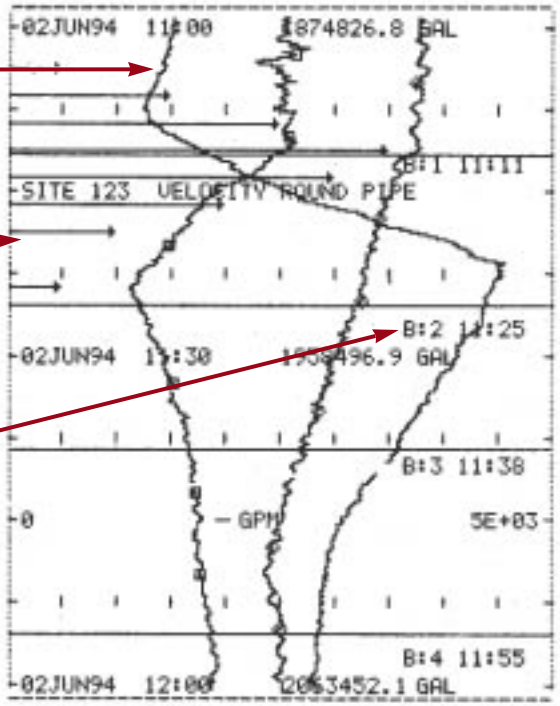
When used with a sampler, the printer records event marks, time and bottle numbers.

Date, time, total flow, site number, and flow conversion are printed for easy reference.

Two summary reports can be printed, each with its own time interval and contents.

Sampler history reports list the date and time of each sample event.

Flow meter history reports include the date and time of important monitoring events.

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REPORT A SITE 123
INTERVAL: 01JUN94 12:00 TO 02JUN94 12:00
TOTAL VOLUME    2063452.1 GAL
    Sampler Volume 170102.1 GAL
INTERVAL VOLUME    2063452.1 GAL
Fwd 2063452.1 GAL Rev          0.0 GAL
FLOW RATE:
    Ave          1703 GPM
    Max          4542 GPM      02JUN94 11:22
    Min          1224 GPM      02JUN94 11:08
LEVEL:
    Ave         0.751 FT
    Max         1.234 FT       02JUN94 11:23
    Min         0.635 FT       02JUN94 11:07
VELOCITY:
    Ave         2.787 FT/S
    Max         3.677 FT/S     02JUN94 11:20
    Min         2.510 FT/S     02JUN94 11:10
pH:
    Ave         7.1
    Max         7.25 pH        02JUN94 05:15
    Min         5.89 pH        02JUN94 11:24
TEMPERATURE:
    Ave         65.4
    Max         67.1 DEG F     01JUN94 14:31
    Min         59.3 DEG F     02JUN94 11:50
RAINFALL:       0.28 IN
-----------------------------------------
SAMPLE HISTORY starting 12:00 01JUN94
    BOTTLE 1      02JUN94    11:11
    BOTTLE 2      02JUN94    11:25
    BOTTLE 3      02JUN94    11:38
    BOTTLE 4      02JUN94    11:55
-----------------------------------------
HISTORY starting 12:00 01JUN94
  01JUN94 13:44 FLOW CONVERSION CHANGED
  01JUN94 13:47 LEVEL ADJUSTED
  01JUN94 13:48 pH ADJUSTED
  01JUN94 13:55 TOTALIZER RESET
  02JUN94 07:12 SAMPLER ENABLED
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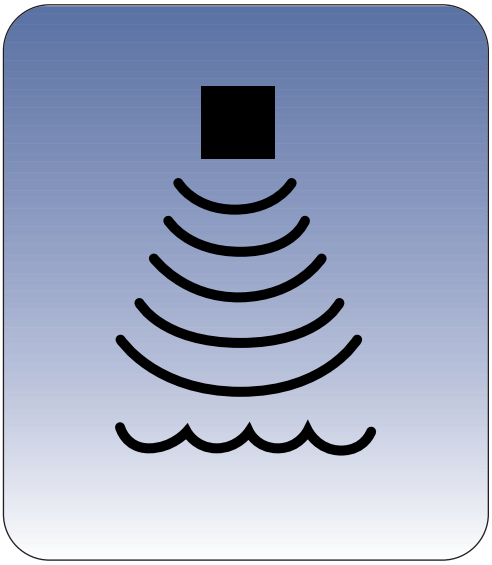
Printout from 4250 Area Velocity Flow Meter shown 85% of actual size.

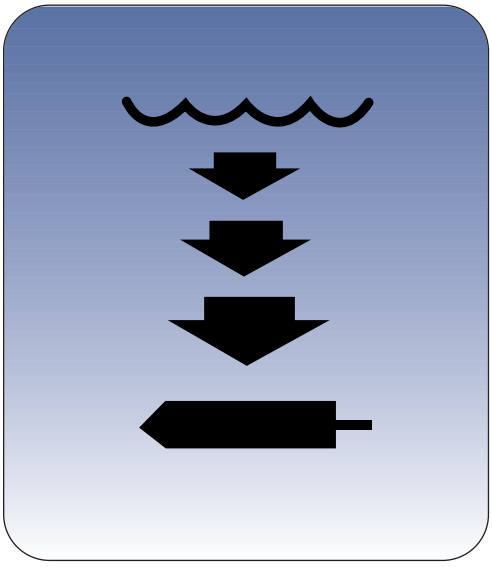
Choose the Best Technology

No single technology is suitable for all open channel flow measurement applications. Only Isco offers you a choice of ultrasonic, submerged probe, bubbler, and area velocity flow meters. The 4200 Series includes the 4210 Ultrasonic, 4220 Submerged Probe, 4230 Bubbler and 4250 Area Velocity Flow Meters. Now you can choose the most accurate technology for each of your monitoring sites.

Please refer to the Flow Measurement Technology Selection Guide on the back cover for more information.

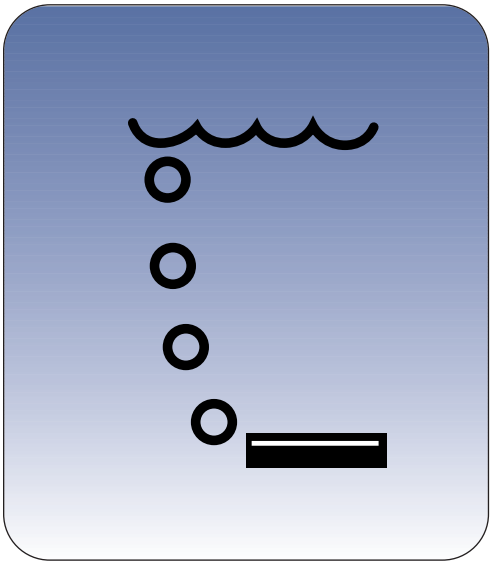
4210 Ultrasonic—for flow measurement in streams containing harsh chemicals, grease or suspended solids. The ultrasonic sensor is mounted above the flow stream and requires no scheduled maintenance. The 4210 measures the level in the channel by transmitting a sound pulse from the sensor and measuring the time for the echo to return from the flow stream surface. The level is then converted into flow rate.





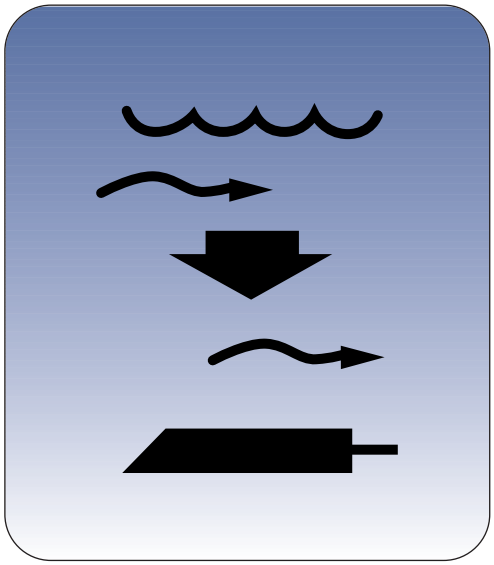
4220 Submerged Probe—ideal for sites where wind, steam, foam or turbulence exist. The probe is mounted at the bottom of the channel and measures the pressure of the liquid above the probe to determine the depth of the flow stream. The 4220 converts the level reading into flow rate.

For Your Applications



4230 Bubbler—resists damage by lightning, debris and corrosive flow stream chemicals. The 4230 uses an internal air compressor to force air from a bubble tube submerged in the flow stream. The depth of the flow is determined by measuring the pressure needed to force bubbles out of the line. The 4230 then converts this depth into flow rate.

4250 Area Velocity—for sites where submerged, surcharged, full pipe or reverse flow conditions may occur. The 4250 sensor is mounted at the bottom of the channel and uses Doppler technology to directly measure average velocity throughout the flow stream. An integral pressure transducer measures depth to determine flow area. The 4250 calculates flow rate by multiplying the area of the flow stream by the average velocity.



Much More Than a Flow Meter

201 pH/Temperature Module

270 DO/Temperature Module

Water Quality Monitoring

In addition to measuring flow rate, Isco 4200 Series Flow Meters can continuously monitor important water quality parameters. Simply connect an Isco 201 pH/Temperature Module, or a 270 DO (dissolved oxygen)/Temperature Module to your 4200 Series Flow Meter.

The rugged modules utilize industry proven pH and DO measurement technologies. By utilizing separate modules, the pH, DO and temperature probes can be placed up to 1000 feet from your flow meter. These modules also eliminate the need for individual measurement and recording instruments.

Parameter Module Specifications

201 and 270 Parameter Modules		
Size *(L x W x D)*	8.5 in. x 4.75 in. x 3.5 in.	21.6 cm x 12.1 cm x 8.9 cm
Weight	2.5 lbs.	1.1 kg
Material	Structural foam molded polystyrene	
Enclosure	NEMA 4X	IP65
Power	10 to 14V DC, 10 mA Maximum *(supplied by 4200 Series Flow Meter)*	
Cable Length *(module to flow meter)*	15 ft. (4.6 m) standard, 1000 ft. (305 m) maximum	
Operating Temperature	32 to 158°F	0 to 70°C
Storage Temperature	-4 to 158°F	-20 to 70°C
pH Probe		
Submersible, vertical or horizontal-mounting probe with combination type electrodes; single or double porous Teflon® liquid junction to resist fouling and coating. Steam-sterilized glass hemi-bulb for long-term stability. Built-in amplifier and internal exposed temperature probe for stability and fast temperature response.		
Size *(L x D)*	6 in. x 1.12 in.	15.2 cm x 2.8 cm
Cable Length	25 ft.	7.6 m
Range	0 to 14 pH	
Accuracy	±0.1%	
Operating Temperature	32 to 176°F	0 to 80°C
Storage Temperature	32 to 176°F	0 to 80°C
Materials		
Probe	Polyphenylene sulfide	
Cable	Polyvinyl chloride (PVC)	

Dissolved Oxygen (DO) Probe		
Polargraphic type using gold cathode, silver anode with 0.002 in. (0.05 mm) Teflon membrane and half-saturated KCl electrolyte solution.		
Size *(L x D)*	2.45 in. x 0.87 in.	6.22 cm x 2.2 cm
Cable Length	12 ft.	3.7 m
Range	0 to 20 ppm (mg/l)	
Accuracy	±0.5 ppm (mg/l)	
Operating Temperature	32 to 113°F	0 to 45°C
Storage Temperature	-4 to 158°F	-20 to 70°C
Materials		
Probe	Acrylic	
Cable	Polyurethane	
O-Ring	EPR Rubber	
Temperature Probe		
Precision linear thermistor enclosed in stainless steel housing.		
Size *(L x D)*	2.5 in. x 0.55 in.	6.35 cm x 1.4 cm
Cable Length	25 ft.	7.6 m
Range	32 to 176°F	0 to 80°C
Accuracy	±1.8°F	±1°C
Materials		
Probe	Type 316 stainless steel	
Cable	Polyvinyl chloride (PVC)	

Integrated Monitoring System

Connect a YSI 600 Multi-Parameter Water Quality Monitor to create System 21, the integrated monitoring system from Isco and YSI. Rugged and compact, the YSI 600 accurately measures pH, DO, conductivity, and temperature, while the 4200 activates and paces sampling based on flow, water quality, and/or rainfall.

Please refer to Isco/YSI System 21 literature for YSI 600 specifications.

Flexible Control and Communication

The 4200 Series offers up to 3 internal analog outputs, allowing you to control processes and drive external equipment. Each output can be scaled based on any flow or parameter measurement, and can also be manually controlled to test the operation of connected equipment.

The 4200s also feature a serial output to communicate with computers, SCADA networks, and similar systems. Current status and readings are transmitted in resonse to a command, or automatically at selected time intervals.

YSI 600 Multi-Parameter Water Quality Monitor

Connect a sampler for flow proportioned sampling, or a rain gauge for storm water runoff monitoring. The flow meter can activate the sampler based on flow, parameters and/or rainfall.

Easy to Upgrade

Nonvolatile "flash" memory makes it easy to use the latest software in your flow meters. You can easily reprogram this memory using a PC, without opening the flow meter or returning it to the factory.

Variety of Power Sources

Isco offers a variety of power sources to meet your specific needs. Select from nickel-cadmium or lead-acid batteries for portable flow monitoring. A solar panel is also available to maintain the charge on a lead-acid battery.

Isco power packs are used in applications where AC power is available. The Battery Backed Power Pack features a built-in battery to power your flow meter when AC power is lost.

Rugged Enclosure

Isco 4200 Series Flow Meters are engineered for portable or fixed-site flow monitoring. Their enclosures meet NEMA 4X and IP65 requirements for watertight, dust-tight and corrosion resistant operation. This ensures dependable operation in the harshest environments.

4210 Ultrasonic Flow Meter

The 4210 Ultrasonic provides non-contact sensing of the flow over a weir.

The sensor on the 4210 Ultrasonic Flow Meter is mounted above the flow stream. It transmits a sound pulse that is reflected by the surface of the flow. The elapsed time between sending a pulse and receiving an echo determines the level in the channel. A built-in temperature sensor automatically compensates for changes in air temperature to ensure measurement accuracy.

Non-contacting Sensor

Because its sensor does not contact the liquid, the 4210 provides long-term dependability with no scheduled maintenance. The Isco 4210 is not affected by chemicals or high concentrations of grease, suspended solids or silt in the flow.

Accurate Under Tough Conditions

The 4210 automatically adjusts amplifier gain in response to echo strength. This patented* technology maximizes performance in the presence of steam, foam and turbulence. And, our Variable Blanking Distance feature eliminates false echo problems caused by obstructions such as manhole rungs or the top of a flume.

*US Patent No. 5,319,974

Isco 4210 Specifications

Flow Meter

Size *(H x W x D) (without power source)*	17.0 in. x 11.5 in. x 10.5 in.	43.2 cm x 29.2 cm x 26.7 cm
Weight *(without power source)*	17.3 lbs.	7.8 kg
Material	High-impact molded polystyrene structural foam	
Enclosure *(self-certified)*	NEMA 4X	IP65
Power	12 to 14V DC, 24 mA average at 12.5V DC (printer set at 1 in./hr (2.5 cm/hr) and 1 minute level reading interval)	
Typical Battery Life	*(printer set at 1 in./hr (2.5 cm/hr) and 1 minute level reading interval)*	
934 Nickel-Cadmium Battery	7 to 8 days	
946 Lead-Acid Battery	10 to 12 days	
948 Lead-Acid Battery	2 to 2½ months	
Program Memory	Non-volatile, programmable flash; can be updated via interrogator port without opening the enclosure	
Display	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)	
Level-to-Flow Rate Conversions		
Weirs	V-notch, rectangular with and without end contractions, Cipolletti	
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco,Trapezoidal, H, HS, HL	
Manning Formula	Round, U-channel, rectangular, trapezoidal	
Data Points	Four sets of 50 level-flow rate points	
Equation	Two-term polynomial	
Totalizers		
LCD	9-digit, floating decimal point, resettable	
Mechanical *(optional)*	7-digit, non-resettable	
Rain Gauge Input	Contact closure, normally open	
Resolution	0.01 or 0.004 in.	0.25 or 0.1 mm
Parameter Inputs	pH, dissolved oxygen, conductivity, and temperature *(with optional YSI 600 Mulit-Parameter Water Quality Monitor);* pH and temperature *(with optional Isco 201 Parameter Module)*; or dissolved oxygen and temperature *(with optional Isco 270 Parameter Module)*	
Sampler Activation Conditions	Enabled, disabled, AND and OR combinations of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature	
Sampler Pacing Output	12V pulse	
Sampler Input	Event mark, bottle number	
Printer		
Recording Modes	Up to 3 graphs of level, flow rate, pH, DO, conductivity, and temperature vs time; includes totalized flow. Rainfall and sampler events (time and bottle number) are also recorded	
Speed	Off, 0.5, 1, 2, 4 inches per hour	Off, 1.25, 2.5, 5, 10 cm per hour
Recording Span	User selectable with multiple over-ranges	
Resolution	1/240 of recording span	
Reports Printed	Flow meter program, 2 independent time interval reports, flow meter history, sampler history	
Interval Report Contents	Site number; time interval; total flow; minimum, maximum, and average flow rate, level, pH, DO, conductivity, and temperature, and time of occurrence; interval flow; total rainfall; number of samples, flow meter history and sampler history	
Character Size	0.09 in. high x 0.07 in. wide (2.4 mm x 1.7 mm), 12 pitch	
Paper	4.5 in. wide x 65 ft. (11.4 cm x 19.8 m) plain white paper, replaceable roll	
Ribbon	19.7 ft. (6.0 m) black nylon, replaceable	

Data Storage Memory		
Capacity	80,000 bytes (approximately 40,000 readings) divided into a maximum of 12 memory partitions; equal to 100 days of level, rainfall, pH, DO, conductivity, and temperature readings at 15 minute intervals, plus 3,000 sample events. Optional expansion to 473,000 bytes (approximately 236,500 readings)	
Setup and Data Retrieval	IBM PC® or compatible computer with Isco Flowlink Software Version 3.1	
Communication	Direct connection, optional internal 2400 baud telephone modem with voice messaging, or optional internal short haul modem	
Data Retrieval *(optional)*	Isco 581 Rapid Transfer Device (RTD)	
Voice Messaging *(with optional internal telephone modem)*	Calls up to 5 telephone numbers with programmable delay between calls, activated based on AND and OR combinations of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature	
Analog Outputs *(optional)*	Up to 3 isolated internal outputs, 0 to 20 mA or 4 to 20 mA, scaleable based on level, flow rate, pH, DO, conductivity, or temperature, into a maximum of 750 ohms each	
Relay Outputs	2 form C relays with field selectable trip points based on flow rate *(with optional High/Low Alarm Relays)*	
Serial Output	Current status and readings, in response to command or automatically at selectable time intervals, ASCII comma separated values at 1200, 2400, 4800, or 9600 baud	
Operating Temperature	0° to 140°F	-18° to 60°C
Storage Temperature	-40° to 140°F	-40° to 60°C

Ultrasonic Sensor

Length	6.9 in.	17.5 cm
Diameter	3.6 in.	9.1 cm
Cable Length	25 ft.	7.6 m
Cable Diameter	0.3 in.	0.8 cm
Weight *(including cable)*	2.6 lbs.	1.2 kg
Enclosure *(self-certified)*	NEMA 4X, 6	IP67
Range *(distance from sensor to liquid)*		
Minimum	2 ft.	0.6 m
Maximum	12 ft.	3.7 m
Span	0 to 10 ft.	0 to 3 m
Level Measurement Accuracy *At 22°C (72°F), still air, and 40 to 70% relative humidity*	**Head Change*** / **Maximum Error**: 1.0 ft. or less ±0.02 ft.; 1.0 to 10 ft. ±0.03 ft.	**Head Change*** / **Maximum Error**: 0.31 m or less ±0.006 m; 0.31 to 3.05 m ±0.009 m
Temperature Coefficient *Maximum error over compensated temperature range (per degree of temperature change)*	±0.000047 x D per °F *Where D is the distance from the transducer to the liquid surface*	±0.000085 x D per °C
Operating Temperature	-22° to 140°F	-30° to 60°C
Compensated Temperature	-22° to 140°F	-30° to 60°C
Materials		
Sensor housing	Xenoy® 6120	
Cable	Polyvinyl chloride (PVC) jacket	

** Actual change in vertical distance between the ultrasonic sensor and the liquid surface*

4220 Submerged Probe Flow Meter

The probe on the Isco 4220 uses a differential pressure trans-ducer to measure the depth of the liquid. The probe's venting system automatically compensates for changes in atmospheric pressure to maintain accuracy.

Accurate Under Tough Conditions

The 4220 provides accurate measure-ment at sites where wind, steam, foam, turbulence or air temperature fluctuations exist. The probe accurately senses pressure even when covered with silt and sand.

Safe for Hazardous Locations

Isco Submerged Probes are UL Classified for use in Class I, Division 1, Groups A, B, C & D hazardous locations when installed using the new Intrinsically Safe Barrier and Quick Disconnect Box. This makes the submerged probe safe to use in locations where flammable gases or vapors may be present.

Fast and Easy Installation

Isco mounting rings make it easy to install the probe in round pipes, man-hole inverts and other open channels. And with the new Isco Street Level Installation Tool, you can install your monitoring system from ground level, eliminating the costs and hazards of entering manholes.

In addition, most flumes are available with an integral recess for mounting an Isco Submerged Probe.

The 4220 Submerged Probe accurately measures depth, even when covered with silt and sand.

Isco 4220 Specifications

Flow Meter

Size *(H x W x D) (without power source)*	17.0 in. x 11.5 in. x 10.5 in.	43.2 cm x 29.2 cm x 26.7 cm
Weight *(without power source)*	17.3 lbs.	7.81 kg
Material	High-impact molded polystyrene structural foam	
Enclosure *(self-certified)*	NEMA 4X	IP65
Power	12 to 14V DC, 15 mA average at 12.5V DC (printer set at 1 in./hr (2.5 cm/hr) and continuous level reading interval)	
Typical Battery Life	*(printer set at 1 in./hr (2.5 cm/hr) and continuous level reading interval)*	
934 Nickel-Cadmium Battery	8 to 11 days	
946 Lead-Acid Battery	12 to 16 days	
948 Lead-Acid Battery	2½ to 3 months	
Program Memory	Non-volatile, programmable flash; can be updated via interrogator port without opening the enclosure	
Display	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)	
Level-to-Flow Rate Conversions		
Weirs	V-notch, rectangular with and without end contractions, Cipolletti	
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco,Trapezoidal, H, HS, HL	
Manning formula	Round, U-channel, rectangular, trapezoidal	
Data Points	Four sets of 50 level-flow rate points	
Equation	Two-term polynomial	
Totalizers		
LCD	9-digit, floating decimal point, resettable	
Mechanical	7-digit, non-resettable *(optional)*	
Rain Gauge Input	Contact closure, normally open	
Resolution	0.01 or 0.004 in.	0.25 or 0.1 mm
Parameter Inputs	pH, dissolved oxygen, conductivity, and temperature *(with optional YSI 600 Mulit-Parameter Water Quality Monitor);* pH and temperature *(with optional Isco 201 Parameter Module)*; or dissolved oxygen and temperature *(with optional Isco 270 Parameter Module)*	
Sampler Activation Conditions	Enabled, disabled, AND and OR combinations of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature	
Sampler Pacing Output	12V pulse	
Sampler Input	Event mark, bottle number	
Printer		
Recording Modes	Up to 3 graphs of level, flow rate, pH, DO, conductivity, and temperature vs time; includes totalized flow. Rainfall and sampler events (time and bottle number) are also recorded	
Speed	Off, 0.5, 1, 2, 4 inches/hour	Off, 1.25, 2.5, 5, 10 cm/hour
Recording Span	User selectable with multiple over-ranges	
Resolution	1/240 of recording span	
Reports Printed	Flow meter program, 2 independent time interval reports, flow meter history, sampler history	
Interval Report Contents	Site number; time interval; total flow; minimum, maximum, and average flow rate, level, pH, DO, conductivity, and temperature, and time of occurrence; interval flow; total rainfall; number of samples, flow meter history and sampler history	
Character Size	0.09 in. high x 0.07 in. wide (2.4 mm x 1.7 mm), 12 pitch	
Paper	4.5 in. wide x 65 ft. (11.4 cm x 19.8 m) plain white paper, replaceable roll	
Ribbon	19.7 ft. (6.0 m) black nylon, replaceable	
Data Storage Memory		
Capacity	80,000 bytes (approximately 40,000 readings) divided into a maximum of 12 memory partitions; equal to 100 days of level, rainfall, pH, DO, conductivity, and temperature readings at 15 minute intervals, plus 3,000 sample events. Optional expansion to 473,000 bytes (approximately 236,500 readings)	
Setup and Data Retrieval	IBM PC or compatible computer with Isco Flowlink Software Version 3.1	
Communication	Direct connection, optional internal 2400 baud telephone modem with voice messaging, or optional internal short haul modem	
Data Retrieval *(optional)*	Isco 581 Rapid Transfer Device (RTD)	

Voice Messaging *(with optional internal telephone modem)*	Calls up to 5 telephone numbers with programmable delay between calls, activated based on AND and OR combination of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature	
Analog Outputs *(optional)*	Up to 3 isolated internal outputs, 0 to 20 mA or 4 to 20 mA, scaleable based on level, flow rate, pH, DO, conductivity, or temperature, into a maximum of 750 ohms each	
Relay Outputs	2 form C relays with field selectable trip points based on flow rate *(with optional High/Low Alarm Relays)*	
Serial Output	Current status and readings, in response to command or automatically at selectable time intervals, ASCII comma separated values at 1200, 2400, 4800, or 9600 baud	
Operating Temperature	0° to 140°F	-18° to 60°C
Storage Temperature	-40° to 140°F	-40° to 60°C

Submerged Probe

Hazardous Location Rating	UL Classified for use in Class I, Division 1, Groups A, B, C, & D hazardous locations as defined by Article 500 of the National Electrical Code when installed with Isco Intrinsically Safe Barrier and Quick Disconnect Box per control drawing 60-3403-131	
Length	9.5 in.	24.1 cm
Diameter	0.875 in.	2.2 cm
Frontal Area	0.765 in.^{2}	4.93 cm^2
Cable Length		
Standard range probe	25 ft.	7.6 m
Extended range probe	50 ft.	15.2 m
Cable Diameter	0.3 in.	0.8 cm
Weight *(including cable)*		
Standard range probe	3 lbs.	1.4 kg
Extended range probe	7 lbs.	3.2 kg
Level Measurement Method	Submerged pressure transducer mounted in the flow stream	
Transducer Type	Differential linear integrated circuit pressure transducer	
Level Measurement Range		
Standard range probe	0.1 to 10 ft.	0.03 to 3.05 m
Extended range probe	0.1 to 30 ft.	0.03 to 9.14 m
Maximum Allowable Level		
Standard range probe	20 ft.	6.1 m
Extended range probe	40 ft.	12.2 m

Level Measurement Accuracy
Non-linearity, repeatability, and hysteresis at 25°C (77°F) (does not include temperature coefficient)

	Level*	Error	Level*	Error
Standard range probe	0.1 to 5.0 ft.	±0.01 ft.	0.03 to 1.52 m	±0.003 m
	0.1 to 7.0 ft.	±0.03 ft.	0.03 to 2.13 m	±0.009 m
	0.1 to 10 ft.	±0.10 ft.	0.03 to 3.05 m	±0.03 m
Extended range probe	0.1 to 15 ft.	±0.03 ft.	0.03 to 4.57 m	±0.009 m
	0.1 to 21 ft.	±0.09 ft.	0.03 to 6.40 m	±0.027 m
	0.1 to 30 ft.	±0.30 ft.	0.03 to 9.14 m	±0.09 m

Temperature Coefficient
Maximum error over compensated temperature range (per degree of temperature change)

	Level*	Error	Level*	Error
Standard range probe	0.1 to 4.0 ft.	±0.005ft./°F	0.03 to 1.22 m	±0.0027 m/°C
	4.0 to 10 ft.	±0.007ft./°F	1.22 to 3.05 m	±0.0038 m/°C
Extended range probe	0.1 to 30 ft.	±0.008ft./°F	0.03 to 9.14 m	±0.0044 m/°C

Operating Temperature	32° to 160°F	0° to 71°C
Compensated Temperature	32° to 100°F	0° to 38°C
Materials		
Submerged probe	Type 316 stainless steel, chlorinated polyvinyl chloride (CPVC)	
Cable	Polyvinyl chloride (PVC)	

** Actual vertical distance between the submerged probe and the liquid surface*

4230 Bubbler Flow Meter

Isco 4230 Bubbler Flow Meters use an internal air compressor to force a metered amount of air through a bubble line submerged in the flow channel. By measuring the pressure needed to force air bubbles out of the line, the level of the water is accurately determined.

Versatile and Accurate

The 4230 provides accurate measurement in a variety of conditions. It is not affected by wind, steam, foam or turbulence. And, because only the bubble tube contacts the flow, corrosive chemicals are not a problem. The 4230 also resists damage by lightning and debris, making it ideal for storm water applications.

Automatic Drift Compensation allows the 4230 to compensate for transducer drift. This makes our bubbler flow meters the most accurate level measurement technology. In standby applications, such as storm water runoff monitoring, Automatic Drift Compensation also allows the 4230 to maintain its level calibration indefinitely.

Dependable Operation

The 4230 is not affected by suspended solids and rapidly changing head heights that can cause problems for some bubbler flow meters. Automatic bubble line purging prevents clogging. And, Isco Super Bubble Software senses rapidly rising heads and increases the bubble rate to maintain maximum accuracy.

A 4230 Bubbler paces an Isco 3700 Sampler to collect flow proportioned samples.

Isco 4230 Specifications

Flow Meter

Size *(H x W x D) (without power source)*	17.0 in. x 11.5 in. x 10.5 in.	43.2 cm x 29.2 cm x 26.7 cm
Weight *(without power source)*	19.1 lbs.	8.6 kg
Material	High-impact molded polystyrene structural foam	
Enclosure *(self-certified)*	NEMA 4X	IP65
Power	12 to 14V DC, 16 mA average at 12.5V DC (printer set at 1 in./hr (2.5 cm/hr), 1 bubble per second, 15 minute purge, and continuous level reading interval)	
Typical Battery Life *(printer set at 1 in./hr (2.5 cm/hr), 1 bubble per second, 15 minute purge, and continuous level reading interval)*		
934 Nickel-Cadmium Battery	7 to 10 days	
946 Lead-Acid Battery	10 to 15 days	
948 Lead-Acid Battery	2 to 3 months	
Program Memory	Non-volatile, programmable flash; can be updated via interrogator port without opening the enclosure	
Display	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)	
Level-to-Flow Rate Conversions		
Weirs	V-notch, rectangular with and without end contractions, Cipolletti, Isco Flow Metering Inserts	
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco,Trapezoidal, H, HS, HL	
Manning formula	Round, U-channel, rectangular, trapezoidal	
Data Points	Four sets of 50 level-flow rate points	
Equation	Two-term polynomial	
Totalizers		
LCD	9-digit, floating decimal point, resettable	
Mechanical	7-digit, non-resettable *(optional)*	
Rain Gauge Input	Contact closure, normally open	
Resolution	0.01 or 0.004 in.	0.25 or 0.1 mm
Parameter Inputs	pH, dissolved oxygen, conductivity, and temperature *(with optional YSI 600 Mulit-Parameter Water Quality Monitor);* pH and temperature *(with optional Isco 201 Parameter Module)*; or dissolved oxygen and temperature *(with optional Isco 270 Parameter Module)*	
Sampler Activation Conditions	Enabled, disabled, AND and OR combinations of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature	
Sampler Pacing Output	12V pulse	
Sampler Input	Event mark, bottle number	
Printer		
Recording Modes	Up to 3 graphs of level, flow rate, pH, DO, conductivity, and temperature vs time; includes totalized flow. Rainfall and sampler events (time and bottle number) are also recorded	
Speed	Off, 0.5, 1, 2, 4 inches per hour	Off, 1.25, 2.5, 5, 10 cm per hour
Recording Span	User selectable with multiple over-ranges	
Resolution	1/240 of recording span	
Reports Printed	Flow meter program, 2 independent time interval reports, flow meter history, sampler history	
Interval Report Contents	Site number; time interval; total flow; minimum, maximum, and average flow rate, level, pH, DO, conductivity, and temperature, and time of occurrence; interval flow; total rainfall; number of samples, flow meter history and sampler history	
Character Size	0.09 in. high x 0.07 in. wide (2.4 mm x 1.7 mm), 12 pitch	
Paper	4.5 in. wide x 65 ft. (11.4 cm x 19.8 m) plain white paper, replaceable roll	
Ribbon	19.7 ft. (6.0 m) black nylon, replaceable	

Data Storage Memory		
Capacity	80,000 bytes (approximately 40,000 readings) divided into a maximum of 12 memory partitions; equal to 100 days of level, rainfall, pH, DO, conductivity, and temperature readings at 15 minute intervals, plus 3,000 sample events. Optional expansion to 473,000 bytes (approximately 236,500 readings)	
Setup and Data Retrieval	IBM PC or compatible computer with Isco Flowlink Software Version 3.1	
Communication	Direct connection, optional internal 2400 baud telephone modem with voice messaging, or optional internal short haul modem	
Data Retrieval *(optional)*	Isco 581 Rapid Transfer Device (RTD)	
Voice Messaging *(with optional internal telephone modem)*	Calls up to 5 telephone numbers with programmable delay between calls, activated based on AND and OR combinations of any two of level, flow rate, rainfall, pH, DO, conductivity, and temperature	
Analog Outputs *(optional)*	Up to 3 isolated internal outputs, 0 to 20 mA or 4 to 20 mA, scaleable based on level, flow rate, pH, DO, conductivity, or temperature, into a maximum of 750 ohms each	
Relay Outputs	2 form C relays with field selectable trip points based on flow rate *(with optional High/Low Alarm Relays)*	
Serial Output	Current status and readings, in response to command or automatically at selectable time intervals, ASCII comma separated values at 1200, 2400, 4800, or 9600 baud	
Operating Temperature	0° to 140°F	-18° to 60°C
Storage Temperature	-40° to 140°F	-40° to 60°C

Bubbler

Range	0.01 to 10 ft.	0.003 to 3.05 m
Level Measurement Accuracy *Linearity, Repeatability, and Hysteresis at 72°F (22°C)*	**Level*** **Error** 0.01 to 1.0 ft. ±0.005 ft. 0.01 to 5.0 ft. ±0.010 ft. 0.01 to 10 ft. ±0.035 ft.	**Level*** **Error** 0.003 to 0.31 m ±0.002 m 0.003 to 1.52 m ±0.003 m 0.003 to 3.05 m ±0.011 m
Temperature Coefficient *Maximum error within compensated temperature range (per degree of temperature change)*	±0.0003 x level x temperature change from 72°F *where level is measured in feet*	±0.0009 x level x temperature change from 22°C *where level is measured in meters*
Automatic Drift Correction	After a 5 minute warm-up period, zero level is corrected to ±0.002 ft. (±0.0006 m) at intervals between 2 and 15 minutes	
Long-Term Level Calibration Change	Typically 0.5% of reading per year	
Ambient Operating Temperature Range	0° to 140°F	-18° to 60°C
Compensated Temperature Range	32° to 140°F	0° to 60°C

** Actual vertical distance between the end of the bubble line and the liquid surface*

4250 Area Velocity Flow Meter

The sensor on the Isco 4250 uses patented* Doppler technology to directly measure average velocity in the flow stream. An integral pressure transducer measures liquid depth to determine flow area. The 4250 then calculates flow rate by multiplying the area of the flow stream by its average velocity.

The 4250 gives you greater accuracy in applications where weirs or flumes are not practical, or where submerged, full pipe, surcharged and reverse flow conditions may occur. And you don't have to estimate the slope and roughness of the channel.

Easy Setup

The 4250's Doppler system eliminates the problems associated with electromagnetic probes. Isco's new Doppler system continuously profiles the flow stream. This saves you time by eliminating profiling and calibration required by electromagnetic systems.

Maintenance-free

The streamlined 4250 sensor sheds debris and withstands corrosive flow stream chemicals. And, unlike electromagnetic probes, the sealed Isco sensor resists fouling by oil and grease, so you're not bothered with frequent cleanings. You can count on the Isco 4250 for long-term, dependable operation.

*US Patent Nos. 5,371,686 and 5,557,536

The 4250 Area Velocity Flow Meter is ideal for sites where submerged, full pipe, surcharged or reverse flows may occur.

Isco offers both Standard and Low Profile Area Velocity Sensors to meet your specific needs. The Standard Sensor (left) is more suitable for use in larger pipes and in turbid flows with high concentrations of suspended solids and entrained air, and may be less susceptible to silting.

The Low Profile Sensor senses velocity in flows typically down to 1" (25 mm) in depth, while its streamlined design minimizes flow stream obstruction. In addition, encapsulation in epoxy provides improved chemical compatibility.

Please refer to literature on the Low Profile Area Velocity Sensor for specifications.

Isco 4250 Specifications

Flow Meter

Size *(H x W x D) (without power source)*	17.0 in. x 11.5 in. x 10.5 in.	43.2 cm x 29.2 cm x 26.7 cm
Weight *(without power source)*	17.3 lbs.	7.81 kg
Material	High-impact molded polystyrene structural foam	
Enclosure *(self-certified)*	NEMA 4X	IP65
Power	12 to 14V DC, 14 mA average at 12.5V DC (printer set at 1 in./hr (2.5 cm/hr), 1 minute level reading interval, and 5 minute velocity reading interval)	
Typical Battery Life	*(printer set at 1 in./hr (2.5 cm/hr), 1 minute level reading, interval, 5 minute velocity reading interval)*	
934 Nickel-Cadmium Battery	8 to 11 days	
946 Lead-Acid Battery	12 to 16 days	
948 Lead-Acid Battery	2½ to 3 months	
Program Memory	Non-volatile, programmable flash; can be updated via interrogator port without opening the enclosure	
Display	Backlit LCD, 2-line, 80-character (5.5 mm high x 3.2 mm wide)	
Level-to-Area Conversions		
Channel shapes	Round, U-shaped, rectangular, trapezoidal	
Data points	Four sets of 50 level-area points	
Level-to-Flow Rate Conversions		
Weirs	V-notch, rectangular and Cipolletti	
Flumes	Parshall, Palmer-Bowlus, Leopold-Lagco,Trapezoidal, H, HS, HL	
Manning formula	Round, U-channel, rectangular, trapezoidal	
Data Points	Four sets of 50 level-flow rate points	
Equation	Two-term polynomial	
Totalizers		
LCD	Total, forward, and reverse flow; 9 digits each, floating decimal point, resettable	
Mechanical *(optional)*	Total flow, 7 digits, non-resettable	
Rain Gauge Input	Contact closure, normally open	
Resolution	0.01 or 0.004 in.	0.25 or 0.1 mm
Parameter Inputs	pH, dissolved oxygen, conductivity, and temperature *(with optional YSI 600 Mulit-Parameter Water Quality Monitor);* pH and temperature *(with optional Isco 201 Parameter Module)*; or dissolved oxygen and temperature *(with optional Isco 270 Parameter Module)*	
Sampler Activation Conditions	Enabled, disabled, AND and OR combinations of any two of level, velocity, flow rate, rainfall, pH, DO, conductivity, and temperature	
Sampler Pacing Output	12V pulse	
Sampler Input	Event mark, bottle number	
Printer		
Recording Modes	Up to 3 graphs of level, velocity, flow rate, pH, DO, conductivity, and temperature vs time; includes totalized flow. Rainfall and sampler events (time and bottle number) are also recorded	
Speed	Off, 0.5, 1, 2, 4 inches per hour	Off, 1.25, 2.5, 5, 10 cm per hour
Recording Span	User selectable with multiple over- and under-ranges	
Resolution	1/240 of recording span	
Reports Printed	Flow meter program, 2 independent time interval reports, flow meter history, sampler history	
Interval Report Contents	Site number; time interval; total, forward and reverse flow; minimum, maximum, and average flow rate, level, velocity, pH, DO, conductivity, and temperature, and time of occurrence; interval flow; total rainfall; number of samples, flow meter history and sampler history	
Character Size	0.09 in. high x 0.07 in. wide (2.4 mm x 1.7 mm), 12 pitch	
Paper	4.5 in. wide x 65 ft. (11.4 cm x 19.8 m) plain white paper, replaceable roll	
Ribbon	19.7 ft. (6.0 m) black nylon, replaceable	
Data Storage Memory		
Capacity	80,000 bytes (approximately 40,000 readings) divided into a maximum of 12 memory partitions; equal to 60 days of level, velocity, rainfall, pH, DO, conductivity, and temperature readings at 15 minute intervals, plus 3,000 sample events. Optional expansion to 473,000 bytes (approximately 236,500 readings)	
Setup and Data Retrieval	IBM PC or compatible computer with Isco Flowlink Software Version 3.1	
Data Storage Memory *(cont'd.)*		
Communication	Direct connection, optional internal 2400 baud telephone modem with voice messaging, or optional internal short haul modem	
Data Retrieval *(optional)*	Isco 581 Rapid Transfer Device (RTD)	
Voice Messaging *(with optional internal telephone modem)*	Calls up to 5 telephone numbers with programmable delay between calls, activated based on AND and OR combinations of any two of level, velocity, flow rate, rainfall, pH, DO, conductivity, and temperature	
Analog Outputs *(optional)*	Up to 3 isolated internal outputs, 0 to 20 mA or 4 to 20 mA, scaleable based on level, velocity, flow rate, pH, DO, conductivity, or temperature, into a maximum of 750 ohms each	
Relay Outputs	2 form C relays with field selectable trip points based on flow rate *(with optional High/Low Alarm Relays)*	
Serial Output	Current status and readings, in response to command or automatically at selectable time intervals, ASCII comma separated values at 1200, 2400, 4800, or 9600 baud	
Operating Temperature	0° to 140°F	-18° to 60°C
Storage Temperature	-40° to 140°F	-40° to 60°C

Standard Area Velocity Sensor

Length	6.6 in.	16.8 cm
Width	1.6 in.	4.1 cm
Height	1.2 in.	3.0 cm
Nose Angle	35° from horizontal	
Cable Length		
Standard range probe	25 ft.	7.6 m
Extended range probe	50 ft.	15.2 m
Cable Diameter	0.37 in.	0.9 cm
Weight *(including cable)*		
Standard range probe	2.1 lbs.	0.96 kg
Extended range probe	3.9 lbs.	1.8 kg
Level Measurement		
Method	Submerged pressure transducer mounted in the flow stream	
Transducer Type	Differential linear integrated circuit pressure transducer	
Range		
Standard range probe	0.05 to 10 ft.	0.015 to 3.05 m
Extended range probe	0.05 to 30 ft.	0.015 to 9.14 m
Maximum Allowable Level		
Standard range probe	20 ft.	6.1 m
Extended range probe	40 ft.	12.2 m

Accuracy *Non-linearity, repeatability, and hysteresis at 25°C (77°F) (does not include temperature coefficient)*

	Level*	Error	Level*	Error
Standard range probe	0.05 to 5.0 ft.	±0.01 ft.	0.015 to 1.52 m	±0.003 m
	0.05 to 7.0 ft.	±0.03 ft.	0.015 to 2.13 m	±0.009 m
	0.05 to 10 ft.	±0.10 ft.	0.015 to 3.05 m	±0.03 m
Extended range probe	0.05 to 15 ft.	±0.03 ft.	0.015 to 4.57 m	±0.009 m
	0.05 to 21 ft.	±0.09 ft.	0.015 to 6.40 m	±0.027 m
	0.05 to 30 ft.	±0.30 ft.	0.015 to 9.14 m	±0.09 m

Temperature Coefficient *Maximum error within compensated temperature range (per degree of temperature change)*

	Level*	Error	Level*	Error
Standard range probe	0.05 to 4.0 ft.	±0.005ft./°F	0.015 to 1.22 m	±0.0027 m/°C
	4.0 to 10 ft.	±0.007ft./°F	1.22 to 3.05 m	±0.0038 m/°C
Extended range probe	0.05 to 30 ft.	±0.008ft./°F	0.015 to 9.14 m	±0.0044 m/°C

Velocity Measurement		
Method	Doppler ultrasonic	
Frequency	500 kHz	
Typical minimum depth for velocity measurement	0.25 ft.	75 mm
Range	-5 to +20 ft./s	-1.5 to +6.1 m/s

Accuracy *(Uniform velocity profile)*

	Velocity	Error	Velocity	Error
	-5 to +5 ft./s	±0.1 ft./s	-1.5 to +1.5 m/s	±0.03 m/s
	5 to 20 ft./s	±2% of reading	1.5 to 6.1 m/s	±2% of reading

Resolution	±0.024 ft./s	±0.0073 m/s
Operating Temperature	32° to 160°F	0° to 71°C
Compensated Temperature	32° to 100°F	0° to 38°C
Materials		
Sensor	Polybutadiene-based polyurethane, stainless steel	
Cable	Polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC)	

** Actual vertical distance between the area velocity sensor and the liquid surface*

4200 Series Flow Meter Accessories

674 Rain Gauge
Tipping bucket design accurately measures on-site rainfall.

Chart Roller
Makes it easy to view and mark flow meter chart paper.

Computer Short Haul Modem
Allows communication with a flow meter up to five miles (8 km) away.

Spreader Bar
For suspending flow meter in a manhole in portable flow monitoring applications.

Ultrasonic Sensor Cable Clamp
Suspends sensor by its cable from Spreader Bar.

Ultrasonic Sensor Cable Straightener
Straightens ultrasonic sensor when suspended by cable.

Ultrasonic Sensor Mounting Bracket
Allows sensor to be secured to a vertical surface.

Ultrasonic Sensor Sunshade
Ensures accurate temperature compensation.

Ultrasonic Sensor Floor Mount
For convenient mounting of the ultrasonic sensor to a horizontal surface.

Ultrasonic Calibration Target
For calibration of an ultrasonic sensor without entering the manhole.

Quick Disconnect Box
Extends distance between submerged probe and flow meter.

Intrinsically Safe Barrier
Allows submerged probe to be installed in hazardous locations.

Flow Metering Inserts
Allows Isco bubbler flow meter to measure flow in sewer pipes without entering the manhole.

Spring Rings
To install flow and parameter sensors in small round pipes.

Scissors Rings
To install sensors in large round pipes and manhole inverts.

Street Level Installation Tool
To install flow and parameter sensors in sewers without entering the manhole.

Power Products

934 Nickel-Cadmium Battery and 946 Lead-Acid Battery

Sealed rechargeable batteries provide power in portable flow monitoring applications.

948 Lead-Acid Battery

45 amp-hour battery with a convenient carrying case and connect cable.

High Capacity Power Packs

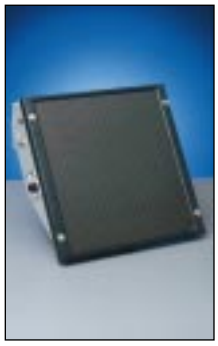
Converts AC power into 12 volts DC to power flow meter or recharge batteries.

Battery Backed Power Packs

AC power packs with built-in battery to power flow meter without interruption in the event of a power outage.

965 Five-Station Battery Charger

Charges up to five Isco 934 Nickel-Cadmium or 946 Lead-Acid Batteries at one time. Powered by 120 or 240V AC.



954 Solar Panel Battery Charger

Charges Isco lead-acid batteries in locations where AC line power is not available.

Ordering Information

Model	Part Number
4210 Ultrasonic Flow Meter	68-4210-001
4210 Accessories	
Sensor Cable Clamp	60-3004-129
Sensor Cable Straightener	60-3213-061
Sensor Mounting Bracket	60-2443-092
Sensor Sunshade	60-3004-142
Sensor Floor Mount	60-3004-117
Calibration Target	60-3004-143
4220 Submerged Probe Flow Meter	
with 10 ft. (3.05 m) level measurement range	68-4220-001
with 30 ft. (9.14 m) level measurement range	68-4220-002
4220 Accessories	
Quick Disconnect Box	60-3224-003
Intrinsically Safe Barrier	60-3404-060
4230 Bubbler Flow Meter	
with 1/16 in. x 25 ft. (1.6 mm x 7.62 m) Teflon bubble line	68-4230-001
with 1/8 in. x 50 ft. (3.2 mm x 15.2 m) vinyl bubble line	68-4230-002
4230 Accessories	
Flow Metering Inserts	
6" (150 mm) Insert	68-3230-005
8" (200 mm) Insert	68-3230-006
10" (250 mm) Insert	68-3230-007
12" (300 mm) Insert	68-3230-008
4250 Area Velocity Flow Meter	
with Low Profile Area Velocity Sensor with 10 ft. (3.05 m) level measurement range	68-4250-006
with Standard Area Velocity Sensor with 10 ft. (3.05 m) level measurement range	68-4250-001
with Standard Area Velocity Sensor with 30 ft. (9.14 m) level measurement range	68-4250-002
4250 Accessories	
Quick Disconnect Box	60-3254-004

Model	Part Number
4200 Series Options	
Telephone Modem with Voice Messaging	68-4200-004
Short Haul Modem	68-3210-009
Analog Outputs	
1 output	60-3214-146
2 outputs	60-3214-148
3 outputs	60-3214-149
Mechanical Totalizer	60-3214-134
4200 Series Accessories	
201 pH/Temperature Module	
with single junction pH probe	68-4200-001
with double junction pH probe	68-4200-002
270 DO/Temperature Module	68-4200-003
674 Rain Gauge	
0.01"	60-3284-001
0.1 mm	68-3280-001
High/Low Alarm Relays	60-3404-028
Chart Roller	60-3004-156
Flowlink Software Version 3	60-2544-043
581 Rapid Transfer Device (RTD)	68-6700-056
Computer Short Haul Modem	60-3214-080
Spreader Bar	60-3004-110
Power Products	
934 Nickel-Cadmium Battery	60-1684-040
946 Lead-Acid Battery	60-3004-106
948 Lead-Acid Battery	68-3000-948
High Capacity Power Packs	
Model 913 120V AC	60-1684-088
Model 923 240V AC	60-3004-190
Battery Backed Power Packs	
Model 914 120V AC	60-3004-130
Model 924 240V AC	60-3004-160
965 Five-Station Battery Charger	68-3000-965
954 Solar Panel Battery Charger	68-3000-027

Flow Measurement Technology Selection Guide

Suitability for Different Applications	Ultrasonic Sensor	Submerged Probe	Bubbler	Area Velocity
Weirs and flumes	Excellent [1]	Excellent	Excellent	Excellent
Channels less than 6 in. (150 mm)	Not recommended	Excellent	Excellent	Not Recommended
Small round pipes, 6 to 8 in. (150 to 200 mm)	Good [2]	Excellent	Excellent	Good
Medium round pipes, 10 to 15 in.(250 to 375 mm)	Good [2]	Excellent	Excellent	Excellent
Large round pipes, 15 to 96 in. (375 to 2500 mm)	Excellent [2]	Good	Excellent	Excellent
Irrigation channels and small streams	Excellent [2]	Good	Excellent	Good
Rivers and large streams	Excellent [2]	Good	Excellent	Good
Chemical Compatibility of Sensor				
Organic solvents	Compatible	Not Recommended	Compatible	Not Recommended
Organic acids	Compatible	Not Recommended	Compatible	Not Recommended
Alcohols	Compatible	Compatible	Compatible	Compatible
Esters	Compatible	Not Recommended	Compatible	Not Recommended
Inorganic acids	Compatible	Not Recommended	Compatible	Not Recommended
Inorganic bases	Compatible	Not Recommended	Compatible	Not Recommended
Inorganic salts	Compatible	Compatible	Compatible	Compatible
Performance Under Adverse Conditions				
Strong wind	Not Recommended	Excellent	Excellent	Excellent
Air temperature fluctuations	Very good [3]	Excellent	Very good [3]	Excellent
Steam above liquid	Not Recommended	Excellent	Excellent	Excellent
Foam on liquid	Not Recommended	Excellent	Excellent	Excellent
Flow stream turbulence	Not Recommended	Excellent	Excellent	Excellent
Floating debris	Not Recommended	Excellent	Excellent	Excellent
Floating oil or grease	Not Recommended	Excellent	Excellent	Excellent
Suspended solids	Excellent	Very good	Good	Very Good
Suspended grease	Excellent	Very good	Good	Very Good
Silting in	Excellent	Very good	Good	Very good
Liquid temperature fluctuations	Very good [4]	Good [4]	Excellent	Good [4]
Submerged flow	Not Recommended	Not Recommended	Not Recommended	Excellent
Full pipe flow	Not Recommended	Not Recommended	Not Recommended	Excellent
Surcharged flow	Not Recommended	Not Recommended	Not Recommended	Excellent
Reverse flow	Not Recommended	Not Recommended	Not Recommended	Excellent
Maintenance Requirements Caused by Adverse Conditions				
Silting in	None	Occasional	Occasional	Occasional
Suspended solids	None	Occasional	Occasional	Occasional
High grease concentration	None	Occasional	Occasional	Occasional

1. Use with caution in small flumes.
2. There must be adequate space above for mounting sensor.
3. Large air temperature fluctuations will affect accuracy.
4. Large water temperature fluctuations wll affect accuracy.

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